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The Attitudes of Field Dependence Learners for Learner Interface Design (LID) in e-Learning Instruction

Ömer Faruk Sözcü*, İsmail İpek, Hüseyin Kınay

Faculty of Education, Fatih University, Turkey

Abstract The purpose of the study is to explore relationships between learners' cognitive styles of field dependence and learner variables in the preference of learner Interface design, attitudes in e-Learning instruction and experience with e-Learning in distance education. Cognitive style has historically referred to a psychological dimension representing consistencies in an individual's manner of cognitive functioning, particularly with respect to acquiring and process information for individuals. In this work, to determine learners' field dependence levels, The Group Embedded Figures Test (GEFT) was administrated to 157 students enrolled in various fields at Fatih University. The attitude survey for students' preferences will be given all participants to clarify their decisions about quality of learner interface design in distance education. The attitude survey was developed and controlled by three content experts in the field of instructional design and technology. Also, it consists of three sections with 20 items including of e-learning experience and learner interface design parts in distance education. To complete this study, cognitive styles such as field dependent (FD), field neutral (FN) and field independent (FI) were defined based on mean score of GEFT groups. One-half Standard deviation of GEFT was added or subtracted to mean, to calculate cognitive styles as FD, FN and FI. The relationships between groups and attitudes and preferences in e-learning instruction were indicated at the end of study. Findings were presented in tables. These tables included some evaluation results for distance education programs as well as successful learning interface design principles which are defined by content, empower, and control with context clarity, visuals, challenges and feedback decisions.

Keywords Cognitive Style, Field Dependence, e-learning, Learner Interface Design

1. Introduction

Recently, the term e-learning, is defined as a vital learning technique in the field of instructional technology to provide contributions with different working locations and learning environments [1]. Computer-based instruction (CBI) was involved and redefined as a multimedia learning in the educational institutions, and also discussed efficiently with the concept of distance education and e-learning technologies [2]. CBI methods are also used in the new concepts of multimedia and e-learning instruction, such as tutorials, drill-practice, simulation, games, and others, and all of them were designed with online instruction [3-5]. With the new technologies, expectations from the instructional process were changed as visual and interface design rules according to user characteristics, including age, attitudes and gender. For this, CBI process has been defined as multimedia instruction and learning [3-4]. There are also relationships between type of instruction such as e-learning or distance education and visual design rules for interface design. High quality lesson design is based on e-learning tools and their visual design characteristics and related tasks. So, multimedia tools can be used for creating effective learning with learner attitudes and perceptions. At the same time, instructional variables can be defined as student age, preferences and cognitive styles as FDI. Cognitive style of field dependence levels were defined as field dependent (FD), field neutral (FN), and field independence based on GEFT scores. Thus, field dependence (FD) is "the tendency to rely on external referents, while field-independence is the tendency to rely upon internal referents" (p.189) [6].

The improvements in multimedia learning have been effectively and efficiently involved in the different cultures internationally with their cognitive perceptions such as visual information, reading text and using technological tools as well. Cognitive styles indicated different learning facts for different learners and users with learning tasks. In addition, cognitive style of field dependence indicates different perceptions, information processing, retrieving, perceiving information, knowledge levels for learners. Cognitive style of field dependence is continuum and includes FD, FN and FI levels for each dependency [6-8]. The term "cognitive styles" refers to the actual way an individual perceives and processes information [9]. The

construct of cognitive style was originally proposed by Allport [10] referring to an individual's habitual way of perceiving, remembering, thinking and problem solving The literature shows more than nineteen cognitive styles such as holistic and serialist, convergent and divergent, field dependent and independent. Field dependence is the cognitive style associated with the most substantive research in the past thirty years [11-15]. Hence, this study focuses on the field dependence/field independence continuum.

Dwyer and Moore [21] indicated that field dependency is an important variable and that for some types of learning objectives, the process of color coding and instructional materials may reduce achievement differences attributed to differences in cognitive style. They also indicated that FD learners scored significantly higher on the drawing test than FI learners on both the black and white- and color-coded treatments [22,23]. There was also a relationship between achievement and attitudes based on cognitive styles for computers [24].

Cultural features of e-learning and their tasks were indicated and presented for marketing management with geographic regions as well as internet or web-based learning [16]. Culture is defined as the patterns of thinking, feeling, understanding events, having perceptions and acting that learners display what they have in minds with information processing as mental programs [17], and culture is also related to learning and education as social implications. Most of the effects of the link between field dependence-independence and interpersonal behavior can be understood as within the differing cognitive styles of information seeking. Culture was defined as formal and informal education, and it was used for teaching people.

As a new technique, e-learning can be defined as instructional concept or learning strategy to make connections between cultures. So e-learning is content delivery and tutorial to provide interactions with learners in different cultures via internet, online or web instruction or other learning tasks. The tasks are related to affective skills, motor control, neurological implications and social implications. Cultures effects, cognitive approaches and several other external factors have been identified related to the cultural influence on the educational systems, distance education and design of e-learning with type of learning environments. From the different perspective, e-learning as a tool was developed based on learner interface design principles which can be presented as content, empower, and control with context clarity, visuals, challenge and feedback decisions in addition to the role of instructor, administrator, attitudes or perceptions of learners' and return on investment (RIO) problems. For this reason, successful learning interface design principles were defined and discussed as a part of e-learning instruction for making learning, technology polite and effective as well as rapid instructional design in e-learning [18-20]. The fact that, learning with technology and attitudes, and preferences for e-learning design strategies have been indicated as vital instructional variables to develop effective, efficient displays with e-learning environments which can be defined as good screens or learner interface design (LID) for meaningful and useful instruction as discussed above [25]. These performances and perceptions can be defined as field dependence and independence concepts for FD/FI learners. Field dependency is a continuum. In short, field dependence includes all levels as FD, FN, and FI. As a result, this study was designed to figure out learners' attitudes and perceptions for learner interface design (LID) in e-learning instruction based on cognitive styles of field dependence. And several research questions were addressed to complete the study as given below.

2. Research Design

2.1. Purpose

The purpose of the study is to explore relationships between learners' cognitive styles of field dependence and learner variables in the preference of learner interface design, attitudes in e-learning instruction and experience with e-learning in distance education. The research questions were developed as follows.

2.2. Research Questions

What are the relationships between cognitive style of field dependence and learner variables in the preference of learner interface design?

1. What are the relationships between cognitive style of field dependence and attitudes in e-learning instruction?
2. What are the relationships between cognitive style of field dependence and experience with e-learning in distance education?

3. Methodology

3.1. Participants

One hundred and fifty seven (157) college freshman-undergraduate students at Fatih University in the fall semester of 2012, in İstanbul, Turkey, were assigned to three cognitive style groups (FD, FN, and FI). The GEFT was used to determine their cognitive style levels as FD, FN, or FI. They were in different programs, their native language was Turkish, and English was their second language. Instruction at the University was in English. As a result, 157 students were participated in the data gathering, voluntarily.

3.2. Gathering Data

The sampling frame used for this study was convenience sampling. For gathering data, the researchers asked instructors who were delivering e-learning instructions in

distance education in different subjects at the university to allow students' willingly participation in the study. The demographics information about the participants is presented in the findings section of this article. The demographics information also includes gender, age, access to distance education, and e-learning with experience.

4. Instruments

4.1. Group Embedded Figure Test (GEFT)

This is a version of the Embedded Figures Test (EFT). It can be used for group administration to measure the FD of students [7, 26]. For this study, GEFT was administered in a 20-minute testing session. There are 25 items. The test contained 3 sections: the first section, with 7 simple items, and the second and third sections, each of which contained 9 more difficult items. The reliability was r= .82. The validity with criterion variable was found to be in the range of .63 to .82. In this work last two sections contain18 items were used for scoring.

4.2. Students Survey

The attitude survey for students' preferences was given participants to clarify their decisions about quality of learner interface design in distance education. The attitude survey was developed and controlled by three content experts in the field of instructional design and technology. That's mean the survey has content and expert validity. And, one author is an expert in the field of measurement and evaluation in education. The survey consists of three sections (A, B, C) with 20 items including of e-learning experience, e-learning instruction attitudes in distance education and preferences learner interface design items in distance education. The responses to the last two sections were analyzed separately by Cronbach's alpha test, and the results yielded a reliability estimate of 0.91 and 0.93, respectively. Each section contains 5, 6 and 9 items in the survey respectively.

5. Analysis of Data

After having responds, we reviewed both all results in literature and our research results and then use SPSS version 15 to analysis answers for each item for students. For this purpose, objectives as indicated were reviewed to explain preferences for each item. As a result, the survey items except for beginning parts are followed by a five–point Likert scale, with the alternatives labeled from 'Strongly disagree (1), to 'Strongly Agree' (5), to avoid halo effect, several questions were phrased negatively. Analyzing data intended to explain main problem and sub research problems as follows. Thus, data analysis was basically completed to clarify those questions in the paper. The range of five-point Likert scale was calculated and evaluated by this formula (5-1)/5. And range mean was calculated as 0.80. All ranges in five-point Likert scale were calculated according to this rule from 5 to 1 scale. As a result, decisions were made about LID variables based on item responds and students' comments in the survey.

6. Findings and Results

Based on GEFT test scores, of those 157 students, 40 students (25.47%) were defined as field dependent, (FD), 57 (36,31%) as field neutral (FN), and 60 (38.22) as field independent (FI) learners. In gender, 128 students (81,5%) were female and 29 (18,5%) were male. Other findings related to demographics information were given in tables.

The cognitive style levels were identified as field independent (high), field neutral-FN, and field dependent (low). Field dependence (low) is demonstrated by achieving scores (low scores $(scores < 10(\overline{X} - 0.5\sigma))$ on the group embedded figure test, and field independence (high) is demonstrated by achieving scores (scores $\geq 14(\overline{X} + 0.5\sigma)$). Students achieving scores $(10 \leq scores < 14(\overline{X} \mp 0.5\sigma)$ were considered to be field-neutral in the study. The test takes approximately 20 minutes for a subject to complete. Materials created by researcher were used to facilitate and examine the performance of students. Students' attitudes and preferences were defined to present instructional e-learning variables based on their cognitive styles of field dependence and learner interface design guidelines. The variables are related to learner interface design (LID) guidelines and its concepts. They consisted of connect, empower, orchestrate parts which are covered by context, challenge, feedback and activity design principles.

6.1. Students' Attitudes and Preferences toward the use of e-learning with Learners Interface Design (LID)

Nine item from student questionnaire aimed to investigate the participants' attitudes toward use of the learner interface design (LID) and its principles including connect, empower, orchestrate parts for effective and efficient e-learning design for distance learning. The descriptive statistics in table 1 show that students agreed with all statements in this category. The LID characteristics were accepted by majority of learners.

Based on Table 1, attitudes and preferences for distance education and learner interface design (LID) principles in using e-learning tools were found, in majority, effective and motivational by 69 students. In addition, Item C2 was supported by 80 students (44%) as a factor for providing needs in e-learning, Other items were agreed by students (in general, over 50%), and defined as important e-learning design variables respectively.

Table 1. Students' attitudes and preferences toward use of the learner interface design

		SD	D	NI	A	SA	Mean	Std Dev.
C1-Effectiveness and motivating learners	F	15	20	53	61	8	3,172	1,0388
	%	9,6	12,7	33,8	38,9	5,1		
C2-Learner friendly design provides needs in learning	F	13	17	47	72	8	3,2866	1,01306
	%	8,3	10,8	29,9	45,9	5,1		
C3-LID in e-learning related to skills what learners do	F	7	17	48	77	8	3,3949	0,91117
	%	4,5	10,8	30,6	49	5,1		
C4-LID provides real problem solving	F	10	26	53	65	3	3,1592	0,94401
	%	6,4	16,6	33,8	41,4	1,9		
C5-Providing visual clarity and control needs	F	9	26	41	68	13	3,3185	1,03179
	%	5,7	16,6	26,1	43,3	8,3		
C6-LID gives learners' meaningful responsibility. what they need with easy and comfortable	F	8	19	46	72	12	3,3885	0,97171
	%	5,1	12,1	29,3	45,9	7,6		
C7-LID is a way that provides learning techniques for lessons	F	8	19	57	65	8	3,293	0,92861
	%	5,1	12,1	36,3	41,4	5,1		
C8-LID makes easy following mobile learning.	F	12	27	36	68	14	3,2866	1,09223
	%	7,6	17,2	22,9	43,3	8,9		
C9- Contents with LID are presented as visual and real clearly with effective feedback	F	11	9	42	68	27	3,5796	1,06294
	%	7	5,7	26,8	43,3	17,2		

Notes: F = frequency, SD = strong disagree, D = disagree, NI = no idea, A = agree, SA = strongly agree; STD = standard deviation

Table 2. Means and standard deviations on survey based on learner interface design (LID) variables and cognitive styles

Items	C1	C2	C3	C4	C5	C6	C7	C8	C9
Mean	3,172	3,2866	3,3949	3,1592	3,3185	3,3885	3,293	3,2866	3,5796
Std. Error of Mean	0,0829	0,0809	0,0727	0,0753	0,0824	0,0776	0,0741	0,0872	0,0848
Median	3	4	4	3	4	4	3	4	4
Std. Dev.	1,0389	1,0131	0,9112	0,944	1,0318	0,9717	0,9286	1,0922	1,0629

As table 2 indicates, the preferences about LID items in survey were given to show connect, empower, orchestrate concepts for designing e-learning environments for distance education which are covered as context, challenge, feedback and activity design principles and also given as statistical values. As indicated in table 2, items in survey based on learner interface design (LID) variables in instruction were preferred very close each other. Basically, there were no differences for students based on field dependence levels. But items C9, C6 and C3 were preferred more based on mean values. Because, these items are strongly related to practical use, skills, meaningful design, and visual and real effects with having feedback for e-learning course. As a result, all items in e-learning design process consider relationships between student preferences and effective learner interface design (LID) principles. Thus, all instructional designers and software designers should be aware of these variables and design facts. And, they also related to context, challenge, feedback and activity design skills in e-learning instruction. According to Allen [18], connect, empower and orchestrate terms in e-learning design defined as CEO that includes context, challenge, activity and feedback terms (CCAF). All interactive learning events and visual designs are built from CCAF and perceptions and preferences can be change a little between FD/FI students as given in research [11-12-18].

According to table 3 results, C7 and C9 items and instructional design variables were found significant for LID in distance education. These values indicated that LID is important for e-learning design and distance education as well as providing feedback and making visuals clear and real for instruction. For this, ANOVA results were given and presented with all items in Table 3.

Table 3. ANOVA results for students' preferences toward Learner Interface Design (LID)

		SS	df	Mean Square	F	Sig.
C1	Between Groups	0,121	2	0,061	0,055	0,946
	Within Groups	168,236	154	1,092		
	Total	168,357	156			
C2	Between Groups	1,139	2	0,569	0,552	0,577
	Within Groups	158,963	154	1,032		
	Total	160,102	156			
C3	Between Groups	0,5	2	0,25	0,298	0,742
	Within Groups	129,016	154	0,838		
	Total	129,516	156			
C4	Between Groups	2,69	2	1,345	1,519	0,222
	Within Groups	136,329	154	0,885		
	Total	139,019	156			
C5	Between Groups	3,003	2	1,501	1,418	0,245
	Within Groups	163,074	154	1,059		
	Total	166,076	156			
C6	Between Groups	3,201	2	1,6	1,71	0,184
	Within Groups	144,099	154	0,936		
	Total	147,299	156			
C7	Between Groups	6,404	2	3,202	3,849	0,023
	Within Groups	128,118	154	0,832		
	Total	134,522	156			
C8	Between Groups	2,091	2	1,045	0,875	0,419
	Within Groups	184,011	154	1,195		
	Total	186,102	156			
C9	Between Groups	6,852	2	3,426	3,115	0,047
	Within Groups	169,403	154	1,1		
	Total	176,255	156			

Students' attitudes and preferences were defined as instructional variables and techniques based on their cognitive styles of field dependence (see table 1 and 4). The variables are related to learner interface design (LID) considerations in distance education as given below. Six questionnaire items in table 4 explored the students' attitudes and preferences toward the use of e-learning instruction as distance education specifically in terms of instructional, visual and technical issues. The results in table 4 and 5 show a slight contradiction. The items show the effects of distance education based on students' attitudes and preferences while learning with distance education and e-learning design tools.

Table 4. Students' attitudes and preferences based on cognitive style toward instructional variables in e-learning instruction (distance education)

		SD	D	NI	A	SA	Mean	Std Dev.
B1 Presenting courses in e-learning	F	6	25	58	53	15	3,293	0,97574
	%	3,8	15,9	36,9	33,8	9,6		
B2 Increasing learner motivation	F	18	24	41	58	16	3,1911	1,16649
	%	11,5	15,3	26,1	36,9	10,2		
B3 Sequencing topics in e-learning	F	7	19	43	68	20	3,4777	1,01012
	%	4,5	12,1	27,4	43,3	12,7		
B4 Using storyboards and screens effect.	F	7	21	43	72	14	3,414	0,98087
	%	4,5	13,4	27,4	45,9	8,9		
B5 Using video and sound well	F	5	14	39	85	14	3,5669	0,89352
	%	3,2	8,9	24,8	54,1	8,9		
B6 instructional videos that are interesting	F	3	18	19	99	18	3,707	0,88623
	%	1,9	11,5	12,1	63,1	11,5		

Notes: F = frequency, SD = strong disagree, D = disagree, NI = no idea, A = agree, SA = strongly agree; STD = standard deviation

Table 5. Means and standard deviations on survey based on the use of e-learning instruction (distance education)

Items	B1	B2	B3	B4	B5	B6
Mean	3,293	3,1911	3,4777	3,414	3,5669	3,707
Std. Error of Mean	0,0779	0,0931	0,0806	0,0783	0,0713	0,0707
Median	3	3	4	4	4	4
Std. Dev.	0,9757	1,1665	1,0101	0,9809	0,8935	0,8862

Table 6. Descriptive statistics for attitudes and distance education variables as learner Interface design (LID) based on cognitive styles

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Learner Interface Design (LID) variables for distance education	FD	40	73,7	14,75301	2,33266	68,9818	78,4182	32	96
	FN	57	76,7368	14,47846	1,91772	72,8952	80,5785	29	105
	FI	60	75,55	15,73878	2,03187	71,4842	79,6158	38	109
	Total	157	75,5096	14,99129	1,19643	73,1463	77,8729	29	109

Table 7. ANOVA for students' attitudes toward Learner Interface design (LID) and FDI

		Sum of Squares	df	Mean Square	F	Sig.
Learner Interface Design variables for e-learning and distance education	Between Groups	216,933	2	108,467	0,479	0,62
	Within Groups	34842,303	154	226,249		
	Total	35059,236	156			

In the study, a broad range of English as a foreign language students from different departments at Fatih University were surveyed to learn their opinions and attitudes about using distance education tolls and learner interface design (LID) for e-learning courses based on cognitive styles. Keeping in mind that previous studies of students' attitudes and preferences based on cognitive style of field dependence were generally conducted in schools. According to cognitive style of field dependence research, each learner in a group shows different perceptions and attitudes for presenting design issues as well as screen and information design. Table 1, 4 and 5 show that items in survey for LID and students' attitudes were conducted. The findings of the investigation are consisted with those of earlier studies [11-15]. Such as students who have an experience and in FI group learner preferred LID principles as well. But there was no meaningful relationships among FDI groups. For this reason, there is a need for experimental research and testing the effects of LID variables in e-learning or distance education. Preferences and attitudes for LID and FDI groups were shown in Table 3, and 4 LID variables and their relationships between or within groups were given in Table 1, 3 and 7 and descriptive analysis and ANOVA results were presented in Table 6 and group relationships and interactions were indicated in Table 7. As a result, the findings indicate that LID variables are useful and very effective for distance education programs and courses. The procedures and results provide benefits with developing instructional software and lesson materials such as video, audio and multimedia projects design for learning and teaching.

7. Discussions

Although the findings show non-significance in formal test of research questions, The LID characteristics were accepted by majority of learners. Students' attitudes and preferences toward the use of e-learning with learners interface design (LID) conclude positive values for different field dependent learners. Based on the students' attitudes and preferences, distance education design variables and e-learning visual design variables were preferred very close by learners. But FI students preferred LID variables in e-learning and distance education course more than FD learners. It is understandable because FI learners better in selecting figures, pictures and having details than FD learners (see Table 6). The variables are related to learner interface design (LID) guidelines and its concepts. E-learning design process includes connect, empower, orchestrate parts which are covered by context, challenge, feedback and activity design principles. For this, the principles can be important instructional variables for designers and instructors [18-20]. As a result, FD/FI learners have clear details for evaluating LID variables such as designing storyboard as visuals and text materials but there was no significant difference between cognitive styles based on preferences, attitudes, and experiences about those variables in the study. The study included college level student age, for future research, demographics variables such as age, social-economic and gender differences should be added.

8. Conclusions

The findings of this study revealed that, at Fatih University, students have positive attitudes toward distance education and e-learning programs because of advantages of e-learning technologies and learner interface design (LID) principles. As a background in distance education and e-learning, learners have indicated and presented e-learning design variables as well as distance education attitudes and preferences. Although there were no interactions and high level correlations between cognitive styles of field dependence and learner interface design (LID) variables, FI learner preferred e-learning technologies and LID characteristics based on theoretical features of cognitive style of FD. Because, cognitive style of FD is a continuum. It was seen that FD, FN or FI learners were defined with their attitudes, perceptions and new research studies must be conducted to develop effective, efficient and engaged e-learning courseware for future distance education and e-learning programs. Finally, e-learning programs with designed effective learner interface design (LID) approach, as a theory and practice side, should be provided with technical, instructional and material-based support for future multimedia projects design. In addition to cognitive style, designers in multimedia should be aware of learner' field dependence as well as distance education and e-learning visuals attitudes.

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